

Combining Sensory Science and Experimental Economics: An Experimental Valuation Study of California Cabernet Sauvignons

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In this research we integrate sensory science techniques—namely, trained sensory panels used to analyze the sensory attributes of wines—with the experimental auction to examine the effects of objective and sensory information in the market for California-produced Cabernet Sauvignons. We chose to focus on California cabernet sauvignons because the study was conducted in California, and California is the largest wine-producing state in the United States by far. This also allowed us to create a nested appellation structure, with California at the base, the two primary North Coast cabernet sauvignon growing areas at the next level (Napa Valley and Sonoma County), and Oakville and Knights Valley—Napa Valley and Sonoma County sub-appellations, respectively—at the top. While it would be best to be able to control for what participants know about each appellation, we are better able to infer intended quality from this variable than we would be able to from grape variety. As long as wine-labeling regulations are met, the use of a qualifying appellation is optional. A winery will choose to label the wine with the “profit-maximizing” appellation—the appellation they expect consumers will value most highly. Therefore, if a winery uses a given eligible appellation, it is because they expect it to be the most valuable in the market. Because of the nested structure of the appellations in our experiment, we can infer that the more specific an appellation the winery uses, the higher the level of quality it is trying to signal.

A 12-member sensory panel trained by the Viticulture and Enology department orthonasally analyzed a group of 20 commercially available California Cabernet Sauvignons at the University of California – Davis Viticulture and Enology department’s sensory science facilities, rating the intensity of each of 17 different nasal (aromas) and 3 different oral (taste) sensations for each wine (see the appendix for a full list of the variables). Judges received no information besides a 20-milliliter sample of each wine. Each judge analyzed each of the 20 wines in triplicate. The judges received the wines according to an orthogonal design; the order and groups in which judges received the wine were balanced to avoid order effects. Wines were presented to the judges in groups of 5.

Once the panel analyzed the group of wines, a principal component analysis (PCA) was performed on the resulting data. PCA takes a number of potentially correlated variables and transforms them into a smaller number of uncorrelated variables. In the context of this research, certain aromas

Due to the alcoholic nature of the product being studied and the need to provide consumers with a non-hypothetical decision setting (see List *American Economic Review* 2001, Vol. 91, No. 5, pp. 1498-1507, or Lusk *American Journal of Agricultural Economics* 2003, Vol. 85, pp. 840-856) for the effects of hypothetical bias on valuation), we partnered with a local retailer holding a liquor license, to which we would sell to participants coupons to be used for the particular bottle of wine.

The laboratory experiment took place at the Robert Mondavi Institute, a new facility housing the sensory science facilities of the University of California – Davis’ Viticulture and Enology Department. The sensory laboratory has 24 individual booths, each containing a computer screen, a mouse, and a door large enough to allow researchers to pass a tray holding sensory samples to the participants. For valuation questions, participants would use an on-screen keyboard to submit a bid for a 750-ml bottle of the wine with the attributes displayed. Participants also provided a hedonic, or liking, rating for each of the wines; for this task, they used a 50-100 point scale.

We held 12 data-collecting sessions of the laboratory research. We made available 24 spots for each session; in the end, 236 people participated in the data-collecting sessions. Participants received \$20 in cash for the opportunity cost of the time spent at the session, which lasted between 60 and 90 minutes. Each research session involved three main components: 1) instructions, 2) demonstration/practice bidding rounds, and 3) binding bidding rounds. To obtain an initial baseline estimate of participant valuation, in Round 1 and Round 5 (the first round of the second group of wines), participants learned that each of the wines was a Cabernet Sauvignon produced within the state of California. In Round 2 and Round 6, participants were given the legal appellation of each wine and submitted bids based on that. In Round 3 and Round 7, the computer revealed the expert rating given to each wine. In Rounds 4 and 8, the winery that produced each wine was revealed.

Rounds 9 and 10 were specific to the second group of wines. Upon reaching Round 9, each participant received their wine samples. After smelling and tasting each wine sample, participants used the 50-100 point scales to rate each wine. Once they had finished rating the wines, they moved on to Round 10. In Round 10, participants were asked to bid on each of the wines in the second group one last time. While considering their bid, participants had all of the information received in rounds 5-8, as well as the rating they themselves had given the wines in Round 9. We obtain a total of 8496 valuations, or bids and 944 hedonic “liking” ratings, as well as demographic information, wine consumption data, and a wine knowledge score for each consumer.

This research generates a rich set of data, allowing us to compare consumer valuation of objective (e.g. label information) and subjective (e.g. taste and aroma of the wines) information, wine attributes obtained from a sensory analysis of the wines with consumer liking rating and valuation, and consumer knowledge and experience with willingness to pay for different variables, among others. These data have implications for hedonic pricing models, labeling regulation, winery decisions on wine manipulation, as well as their role as information on valuation. We find a significant level of heterogeneity in consumer sensory preferences, consumer knowledge, and consumer valuation conditional on knowledge. Other results are expected: consumers value a cabernet sauvignon labeled from Napa Valley or Sonoma County more highly than one labeled with the California appellation. The effect of wine expert ratings is also significant and positive, but is tempered by the expectations imbued by the appellation.